

# NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

## FILTER AREA (Acre) CODE 393

### **DEFINITION**

An area of vegetation for removing sediment, organic matter, and other pollutants from wastewater.

### **SCOPE**

This standard establishes the minimally acceptable requirements for design and operation and maintenance of filter areas for removing sediment, organic matter, and other pollutants and utilizing nutrients from wastewater.

### **PURPOSE**

To remove sediment and other pollutants from waste water by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing pollution and protecting the environment.

### **CONDITIONS WHERE PRACTICE APPLIES**

This practice applies in locations requiring filter areas as part of a waste management system to treat wastewater. This practice does not apply to management of human or industrial wastes.

### **DESIGN CRITERIA**

#### **General Criteria Applicable to All Purposes**

There shall be a minimum of 2 feet of soil depth between finished grade and bedrock or the seasonal high water table.

Filter area slopes shall be between one percent and 15 percent.

Clean water runoff from the 25-year storm shall be diverted around the filter area.

A filter area may not be located within the regulatory floodway of any stream or up gradient from an open sinkhole, a spring, or a well.

The Critical Area Planting Standard and Specification (342) shall be used to determine vegetative requirements adapted to the site and the water, sediment, nutrients, and pollutants to be applied to the filter area. No plants listed on the noxious weed list of the state will be established in the filter area.

The filter area shall be fenced according to the Fencing Standard and Specification (382) to control grazing if livestock will have access to the filter area.

Sheet flow across the full width of the filter area shall be maintained for the full length of the filter area.

### **Additional Criteria for Filter Areas for Runoff from Concentrated Livestock Areas**

These criteria apply to filter areas for runoff from feedlots, barnyards, manure stacking facilities, and composting facilities.

A settling facility shall be provided between the waste source and filter area.

The settling facility shall have sufficient capacity, as a minimum, to store the runoff computed for 15 minutes' duration at the peak inflow rate resulting from a 2-year rainfall. Any basin outflow shall be disregarded in computing minimum storage. Additional storage capacity, based on frequency of cleaning, shall be provided for manure and other solids settled within the basin. If the basin is to be cleaned after every significant runoff event, additional storage equivalent to at least 0.5 in. from the concentrated waste area shall be provided. If infrequent cleaning of the basin is planned, additional storage equivalent to at least 0.5 in. from the concentrated waste area shall be provided for each month between planned cleanings.

The settling facility shall be designed to completely discharge the 2-year storm runoff in no longer than 24 hours, and not produce a sustained trickle flow to the filter area.

In addition, the criteria in the Sediment Basin (350) standard shall be met if the contributing drainage area exceeds one acre or the settling facility includes an embankment greater than three feet high.

A filter area may be a uniformly sloping grass area or a grass channel. Minimum dimensions shall be based on the peak outflow from the settling facility based on a 2-year rainfall. Regardless of the filter shape, provide an area adequate for a maximum application rate of 2" per week including direct precipitation on the filter area, based on the highest long term average monthly precipitation for the locality.

Filter areas shall be generally on the contour and sufficiently wide to pass the peak flow at a depth of 0.5 in. or less. Flow length shall be sufficient to provide at least 15 minutes of flow-through time, calculated using a Manning's  $n = 0.24$ .

Grass filter channels shall be designed to carry the peak flow at a depth of 0.5 ft or less. Flow length shall be sufficient to provide at least 30 minutes of flow-through time using D-retardance. Grass species and shape of channel shall be such that grass stems will remain upright during design flow.

### **Additional Criteria for Filter Areas for Controlled Overland Flow Treatment of Liquid Wastes**

These criteria apply to filter areas for waste water from milk parlors, milking centers, waste treatment lagoons, on-farm food processing plants, silos, and waste storage facilities.

If suspended solids are expected in the waste water, provide a settling facility with a minimum of two day detention volume for floatable and settleable solids. The outlet from this settling facility shall be gravity flow. A pump or siphon for distribution of waste water shall be located in a dosing tank separate from the settling facility.

The filter area shall be dosed with the volume of flow from the waste water source or from the settling facility if required. The peak flow used to size the filter shall be based on the capacity of the pump, siphon, or gravity discharge pipe.

Gravity discharge (without a pump or siphon) may be used to dose a filter area only if the duration of flow is less than three hours per day. It provides uniform distribution of the flow across the head of the filter area. It does not produce a

sustained trickle flow to the filter area. The filter area is rested as required below. The filter area soil has a permeability less than 2.0" per hour, and the filter slope is greater than 2%.

Wastewater shall be applied to a filter area on no more than one of any three consecutive days to provide a rest period for the vegetation, maintain an aerobic soil condition, and prevent deep percolation of waste water.

The minimum filter area size shall be determined by the greater of either:

a. Hydraulic loading rate - provide an area adequate for a maximum application rate of 2" per week including direct precipitation on the filter area, based on the highest long term average monthly precipitation for the locality. The weekly application rate shall be compatible with the filter area soils to prevent percolation below the root zone and surface runoff from the filter area under normal soil conditions, or

b. Detention time – a minimum flow through time of 15 minutes at a maximum flow depth of 0.5" using a Manning's  $n = 0.24$ . considerations

Evaluate type and quantity of pollutant, slopes and soils, adapted vegetative species, time of year for proper establishment of vegetation, necessity for irrigation, visual aspects, fire hazards, and other special needs.

Filter areas by themselves may not meet the "no-discharge" requirement applicable to livestock operations requiring permits under the National Pollutant Discharge Elimination System. More stringent pollution abatement measures may also be necessary where receiving waters must be highly protected.

The following must be considered:

1. Adequate soil drainage to ensure satisfactory performance. Filter areas are

more effective if alternate (rest) areas are provided, especially if soils with very slow or slow permeability are used.

2. Reduced effectiveness of filter areas under snow or frozen conditions increases the importance of a vegetated buffer between the filter area and a water body.

3. Slopes between 2 and 6 percent are most effective; steeper slopes require a greater area and length of flow; flatter slopes may promote excessive infiltration or puddling at the head of the filter area.

4. The need for a level lip weir, gated pipe, sprinklers, or other facilities to distribute flow uniformly across the top of the filter area and maintain sheet flow through the filter area.

5. Sheet flow can be maintained throughout the length of the filter area with stone berms or shallow furrows spaced at intervals of 50 feet or less, especially on slopes greater than six percent. This technique should be given extra consideration where a proposed filter area is relatively uniform in cross section and has a well developed sod, as an alternative to disturbing the existing sod and soil profile to regrade the filter area.

6. Provisions for mowing and removing vegetation to utilize the nutrients and maintain the effectiveness of the filter area. Controlled grazing may be satisfactory when the filter area is dry and firm.

7. The potential for odors from the settling facility or the filter area.

## **OPERATION AND MAINTENANCE**

A written operation and maintenance plan shall be provided and reviewed with the landowner. The plan shall address the following items and any other site-specific items necessary to keep the filter operating as designed.

Development of rills and small channels within filter areas must be minimized.

Needed repairs must be made immediately to reestablish sheet flow. A shallow furrow on the contour across the filter can be used to reestablish sheet flow. Vegetation must be maintained in a vigorous condition. If livestock have access to the filter area, it must be fenced to control grazing.

## **PLANS AND SPECIFICATIONS**

Plans and specifications for filter areas shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

## **DESIGN AND CHECK DATA REQUIREMENTS**

### **Survey Record**

1. Sketch of layout, including settling facility, pipeline, and filter area.
2. Surveyed profile along the proposed centerline of the system.

### **Design Record**

1. Waste water volumes and flow rates.
2. Calculations for sizes of settling facility, dosing system, and filter area.
3. Plotted profiles of ground surface and designed system components.
4. Plan view showing locations of existing and designed facilities.
5. List of materials needed to install the system.
6. Pump or siphon requirements including design flow (gpm), total head, and solids handling capacity.
7. Specification 393 and any others needed to install the practice.
8. Operation and Maintenance Plan provided to land owner.
9. Erosion and sediment control plan.

## **Construction Check and As-Built Drawing**

1. Measurements to show all components were installed as designed or as otherwise modified by the authorized personnel in the field.
2. Name of pump or siphon manufacturer, model number, and performance curve or capacity.
3. Length, kind, and size pipes.
4. Check of solids retention devices in settling facility.
5. Location sketch of lines installed.
6. Fence installation where needed to manage access by livestock.

## **CONSTRUCTION SPECIFICATION**

### **1. SCOPE**

The work shall consist of furnishing materials and installing all components for the filter area as outlined in this specification and the drawings.

Construction work covered by this specification shall not be performed between December 1st and the following March 15th unless the site condition and/or construction methods to be used have been reviewed and approved by the responsible Engineer or his/her Representative.

### **2. MATERIALS**

a. PRECAST CONCRETE units shall comply with ACI-525 and 533.

b. JOINT SEALERS shall conform to the requirements for ASTM-C920 as set forth in Section 7, or Federal Specification SS-S-210A; except that sealers for vertical or overhead application must meet the requirements of Federal Specification TT-S-227, Type II.

c. WATERSTOPS. Vinyl-chloride polymer types shall be tested in accordance with Federal Test Method Standard No. 601, and shall show no sign of web failure due to brittleness at a temperature of -35 degrees Fahrenheit. Colloidal waterstops shall be at least 75 percent bentonite in accordance with Federal Specification SS-S-210A.

d. PLASTIC PIPE AND APPURTENANCES shall meet the following requirements, unless otherwise set forth in Section 7.

Appurtenances such as fittings, coupling bands, collars, end section, etc. shall be composed of the same material as the pipe and conform to the appropriate industry standard.

| <b><u>Kind of Pipe</u></b>  | <b><u>ASTM Specification</u></b> |
|---|----------------------------------|
| Poly (Vinyl Chloride) (PVC)<br>Plastic Pipe, Schedules 40, 80, 120                  | D1785                            |
| Poly (Vinyl Chloride) (PVC)<br>Pressure-Rated Pipe (SDR Series)                     | D2241                            |
| Polyethylene (PE)<br>Plastic Pipe, Schedule 40                                      | D2104                            |
| Polyethylene (PE)<br>Plastic Pipe, (SIDR-PR)<br>Based on Controlled Inside Diameter | D2239                            |
| Polyethylene (PE)<br>Plastic Pipe, Schedules 40 & 80,<br>Based on Outside Diameter  | D2447                            |
| Polyethylene (PE)<br>Plastic Pipe, (SDR-PR)<br>Based on Controlled Outside Diameter | D3035                            |
| Polyethylene (PE)<br>Plastic Pipe, (SDR-PR)<br>Based on Outside Diameter            | F714                             |
| Acrylonitrile-Butadiene-Styrene<br>(ABS) Plastic Pipe, Schedules 40 & 80            | D1527                            |
| Acrylonitrile-Butadiene-Styrene<br>(ABS) Plastic Pipe, (SDR-PR)                     | D2282                            |

### 3. FOUNDATION PREPARATION

Only track mounted equipment and vehicles shall be permitted within the filter area.

All trees, brush, fences, manure, silage and rubbish shall be cleared within the area of the filter and any borrow areas. All stumps, roots larger than four inches in diameter, and rubbish shall be removed from the designated earth fill areas to a depth of at least six inches below the existing ground surface. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative.

Unless otherwise set forth in Section 7, existing topsoil and sod shall be stripped from the designated excavation or fill areas of the filter and any borrow areas. Sufficient topsoil is to be stockpiled in a convenient location for use on the filter area and other disturbed areas to facilitate seeding. Final grading of the foundation prior to any fill placement shall remove all rocks larger than six inches and all saturated soil, and any slopes steeper than 1:1.

The filter area shall be excavated to the lines, grades and elevations shown on the drawings, or as described in Section 7. The materials excavated from the filter shall be placed in one of the following ways:

- a. as shown on the drawings or as described in Section 7. If not applicable, then
- b. uniformly spread outside the filter area to a height not exceeding three feet with the top graded to a continuous slope away from the filter area, or
- c. hauled to a disposal area as directed by the Landowner.

### 4. EARTH FILL

The fill material shown in the drawings shall be obtained from the designated borrow areas and/or required excavations. The material shall be free from stumps, wood, brush, roots, sod, rubbish, and other matter that may decay. It should also be free of stones over six inches in diameter. Frozen material shall not be placed in the fill nor shall the fill material be placed on a frozen foundation.

Prior to placing the fill material on any portion of the foundation, that portion shall be scarified, plowed, or disked to a depth of three inches. All objectionable material exposed by this operation, i.e., other than the mineral soil that has been identified for use as fill, shall be disposed of as directed by the Owner.

The thickness of each layer of fill prior to compaction shall be no greater than 12 inches. Materials placed on the fill by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness.

The only compaction required or desired is that achieved in the process of placing the fill. The entire fill surface shall receive at least one pass, but no more than three passes, of the tracked equipment.

The moisture content of the fill material shall be maintained within the limits required to: (a) prevent bulking or dilatance of the material under the action of the compaction equipment; (b) prevent the adherence of the fill material to the tracks of the equipment; and (c) insure the crushing and blending of the soil clods and aggregations into a reasonably homogeneous mass. The fill material should contain sufficient moisture so that it can be formed into a ball. If water can be squeezed out of the ball, it is too wet to compact properly and shall be dried prior to

compaction. Dry soil (that cannot be formed into a ball or that produces dust under traffic) shall be wetted and mixed prior to compaction.

## **5. TOPSOIL PLACEMENT**

Only track mounted equipment shall be permitted on the filter area.

All of the stockpiled topsoil shall be spread over the entire re-graded surface of the filter area. The topsoil shall be uniformly spread to the finished grades. The topsoil shall be dry enough that it does not adhere to the equipment tracks. Equipment traffic on the topsoil shall be kept to an absolute minimum.

## **6. SEEDING**

Vegetative cover shall be established on all disturbed areas. Liming, seeding, fertilizing and mulching shall conform to Specification 342 for Critical Area Planting.

The final passes of equipment used in seedbed preparation shall be across the slope of the filter. Vehicle and equipment traffic shall not enter the filter area after the seedbed is prepared.

The filter area shall be fenced where shown on the drawings or as described in Section 7 to protect the vegetation.

## **7. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:**

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the  
Natural Resources Conservation Service.